



## NASA SBIR 2015 Phase I Solicitation

### **Z2 Lightweight Materials, Structures, and Advanced Manufacturing/Assembly**

Lead Center: LaRC

The Lightweight Materials, Structures, and Advanced Manufacturing/Assembly SBIR topic area will focus on technologies that will enable mass reduction, improved performance, lower cost and scalability of the material and structural systems that will be critical to NASA's space exploration and missions. As NASA strives to explore deeper into space than ever before, improvements in all of these areas will be critical. For example, mass reduction is an ever-present goal in the development of space exploration systems. Reductions in structural mass can either enable additional payload to be launched to orbit or reduce the mass of the payload that must be returned to Earth or landed on another planetary surface. Application areas for the material, structural, and manufacturing/assembly technologies developed under this SBIR topic include launch and crew vehicles, in-space transportation elements, habitation and crew-transfer systems, surface systems, and other systems used for space exploration.

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Since this topic area has a broad range of interest, subtopics are selected by the Space Technology Mission Directorate to enhance and/or fill gaps in the exploration technology development programs and to complement other mission directorate topic areas. Advances in composite, metallic, and ceramic material systems are of interest in this topic, as are advances in the associated manufacturing methods for these various material systems. Significant advances can be realized by improvements in material formulation through improvements in the capabilities to manufacture and assemble large-scale structural components. Therefore, subtopics of interest will include but will not be limited to nanomaterial and nanostructures development, advanced metallic materials and processes development, and large-scale polymer matrix composite structures, materials, and manufacturing technologies. Other sub-topic areas may be added as required to address specific agency needs.

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The subtopic of interest for FY15 addresses large-scale polymer matrix composite (PMC) structures and materials, and concentrates on developing lightweight structures using advanced materials technologies and new manufacturing processes. Out of autoclave material systems and processing as well as joining technologies to enable 5 - 9 m diameter composite structures will be of interest. The specific needs and metrics of this focus area is described in the subtopic description.Â

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Research awarded under this topic should be conducted to demonstrate technical feasibility (proof of concept) during Phase I and show a path toward a Phase II hardware demonstration, and when possible, deliver a full-scale demonstration unit for functional and environmental testing at the completion of the Phase II contract.

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References:

- (<http://www.nasa.gov/directorates/spacetech/home/index.html>).

## Subtopics

### 22.01 Large-Scale Polymer Matrix Composite (PMC) Structures, Materials, and Manufacturing Processes

Lead Center: MSFC

Participating Center(s): LaRC

The subtopic area for Large-Scale Polymer Matrix Composite (PMC) Structures and Materials concentrates on developing lightweight structures, using advanced materials technologies and new manufacturing processes. The objective of the subtopic is to advance technology readiness levels of PMC materials and manufacturing for launch vehicles and in-space applications resulting in structures having affordable, reliable, and predictable performance. A key to better understanding predictable performance and faster qualification of components includes integrating the analytical tools between the materials and manufacturing process.Â

The subtopic will focus efforts to enable large (5 to 9 meter) diameter composite structures. Specific areas of interest include advances in PMC high performing resin/fiber material systems and associated out-of-autoclave processes for the manufacturing of large composite structures and innovative low cost, high reliability composite joint concepts/techniques. Proposals to each area will be considered separately:Â

- Advances in PMC high performing resin/fiber systems which can be cured via out of autoclave processes (such as resin infusion, or equivalent) which will yield large complex composite structures. Properties for this material system should use IM7/8552-1 or IM7/977-2 toughened epoxy systems as a baseline goal. Acceptable properties are key, but end-to-end manufacturing process evaluation should be considered to support scale-up including integration of modeling and potential automation of the processes.
- Innovative low cost, high reliability composite joining concepts/techniques for attaching large segmented structures together. Concepts must consider end-to-end process evaluation with considerations to modeling of the joint/joining process and to full-size scale-up factors which will limit autoclave and oven access for joint cures. Concepts that are amenable to in-situ and/or on-orbit implementation are also of interest.

Research should be conducted to demonstrate novel approaches, technical feasibility, and basic performance characterization for large-scale PMC structures and joint concepts during Phase I, and show a path toward a Phase II design allowables and prototype demonstration. Emphasis should be on demonstrable manufacturing technology that can be scaled up for very large structures.Â

References:

- Kirsch, M. T., â&#128;&#156;Composite Crew Module: Primary Structure.â&#128;&#157; (<http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20110020665.pdf>).
- Tenney, D. R. et al., â&#128;&#156;NASA Composite Materials Development: Lessons Learned and Future Challenges,â&#128;&#157; (<http://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20090037429.pdf>).
- â&#128;&#156;Composite Cryotank Technologies & Demonstration.â&#128;&#157; ([https://gcd.larc.nasa.gov/wp-content/uploads/2013/07/FS\\_CCTD\\_factsheet.pdf](https://gcd.larc.nasa.gov/wp-content/uploads/2013/07/FS_CCTD_factsheet.pdf)).